COMPARATIVE EVALUATION OF DAO & ECMWF FOR CERES CLOUD PROPERTIES RETRIEVALS

P. Minnis, S. Sun-Mack, Q. Z. Trepte, Y. Chan

CERES Telecon, October 8, 2003

OBJECTIVE:

Determine if DAO skin temperature & atmospheric profiles can serve as a suitable substitute for a similar ECMWF product currently used by CERES

TESTS

- Compare skin vs observed temperatures
- Compare cloud amount statistics
- Compare cloud amounts for selected cases
- Examine time series of EC-based products to determine if results vary with changes in EC formulation

DATA

Parameter	ECMWF	DAO, GEOS 4.0.3
Profiles, x-y	1°	1°
Skin T, x-y	0.5°	1°
Profiles, t	6 hr	6 hr
Skin T, t	3 hr	3 hr

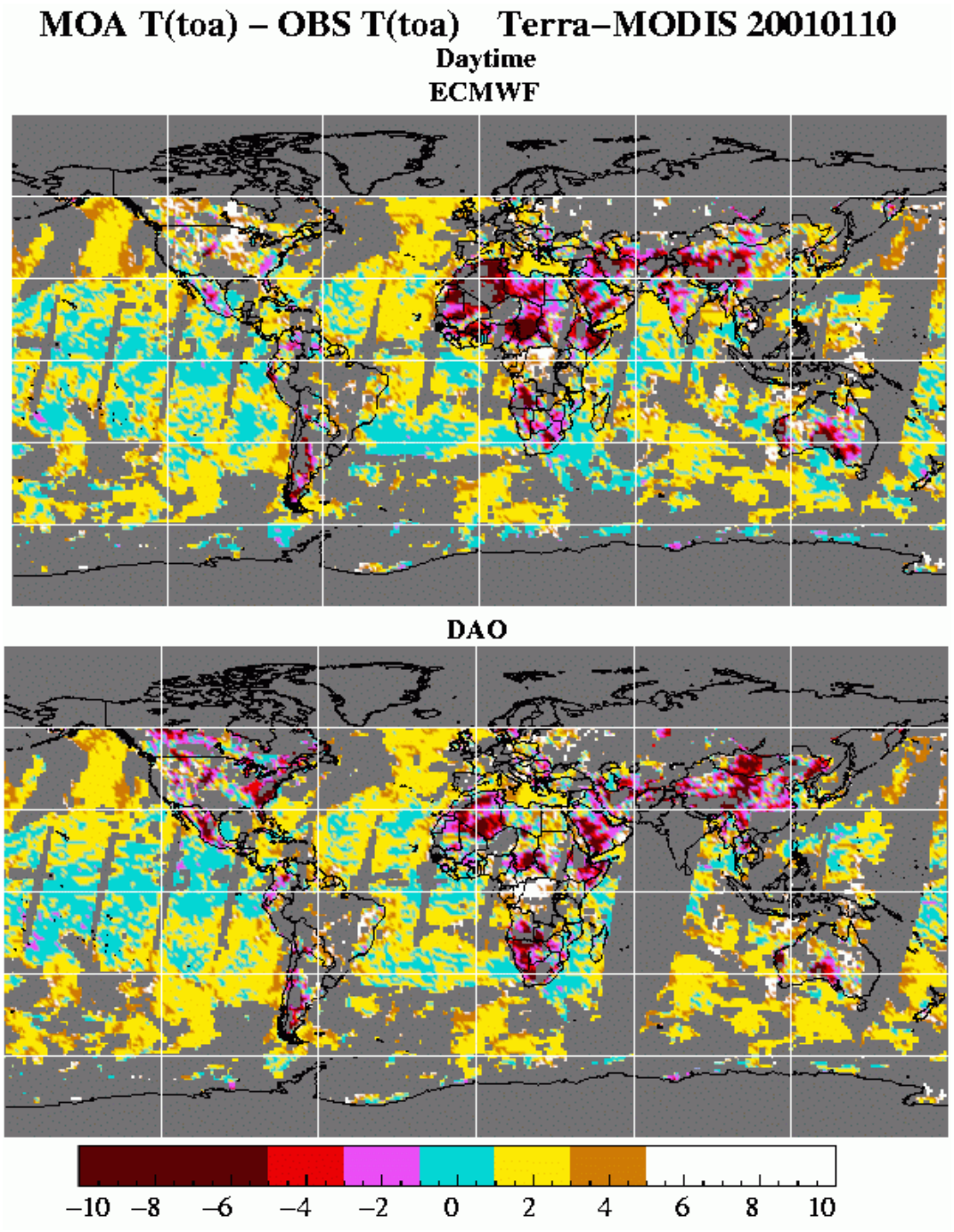
Dates, 2001

January 3, 10, 17; April 4, 15, 22; July 6, 7, 12; October 14, 21

Clear Temperature Comparison 1/10/2001

daytime

Biggest disagreements over deserts and USA

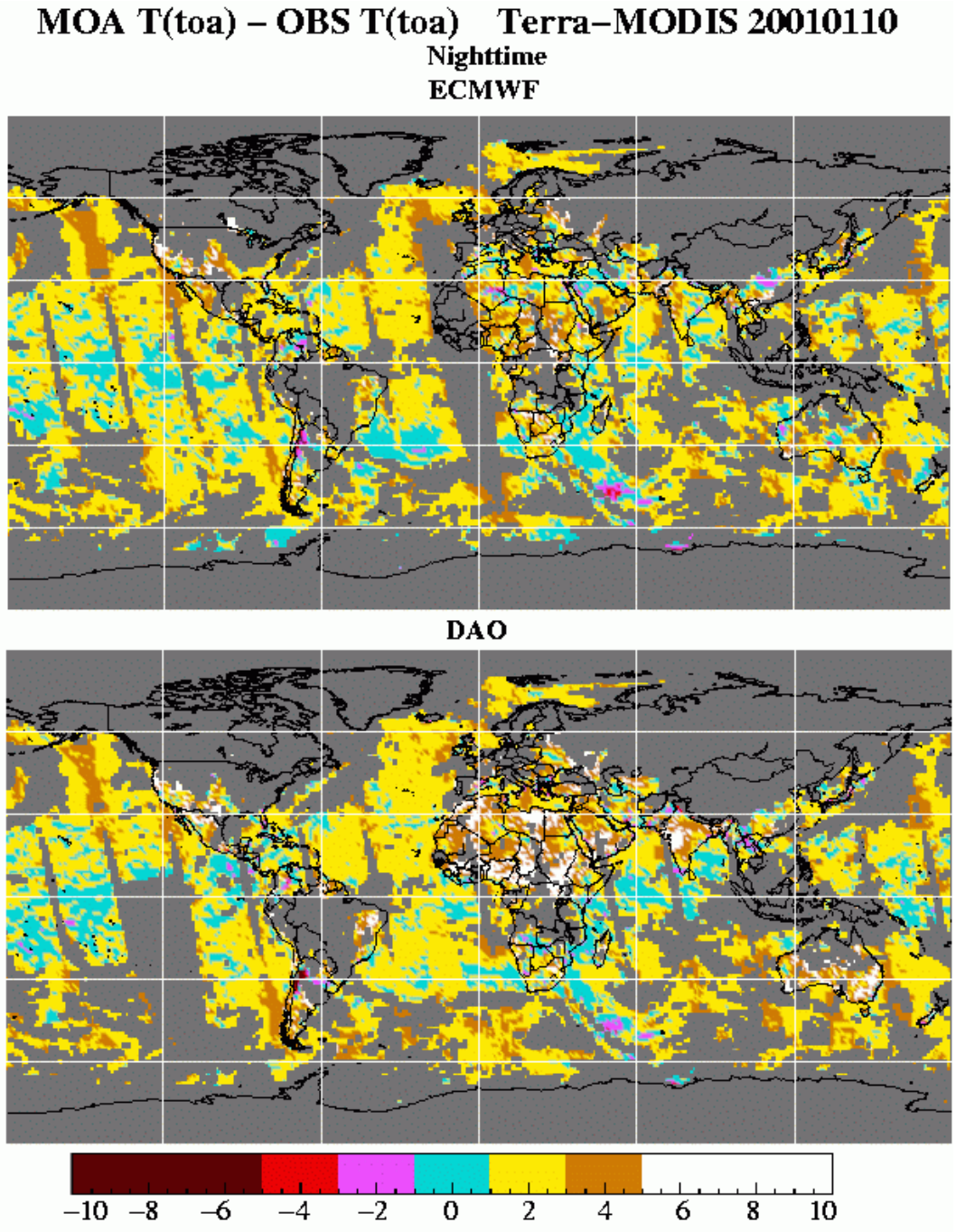


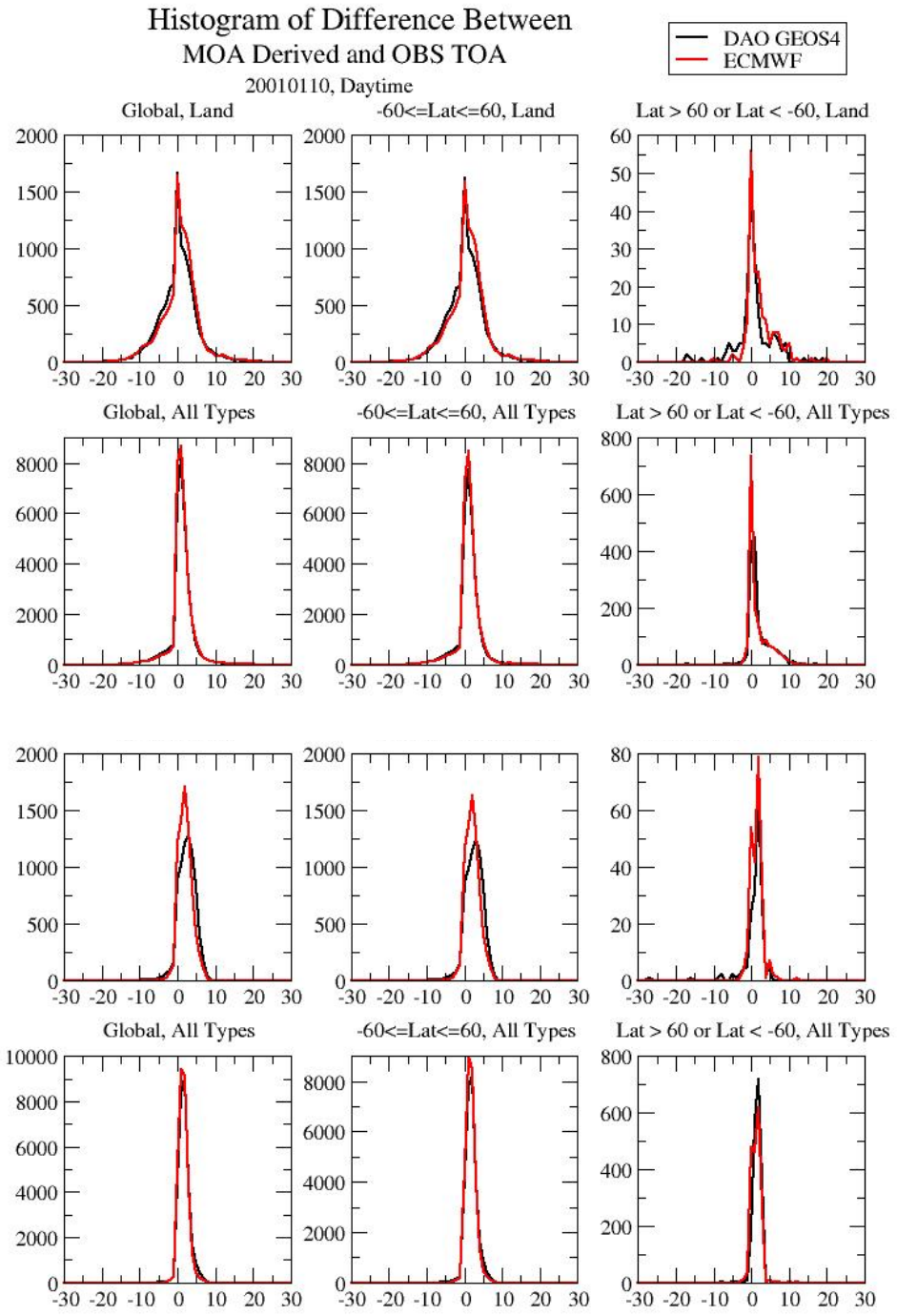
Clear Temperature Comparison 1/10/2001

nighttime

Biggest disagreements over deserts and USA

Note: DAO clouds over SE USA. DAO much warmer over Sahara, India, & Australia





Day

Night

Good agreement over areas thought to be clear - locations & number of points differ because of different cloud amounts

Good agreement over oceans.

DAO tends to be warmer over land at night

SUMMARY OF CLEAR TEMP DIFFERENCES

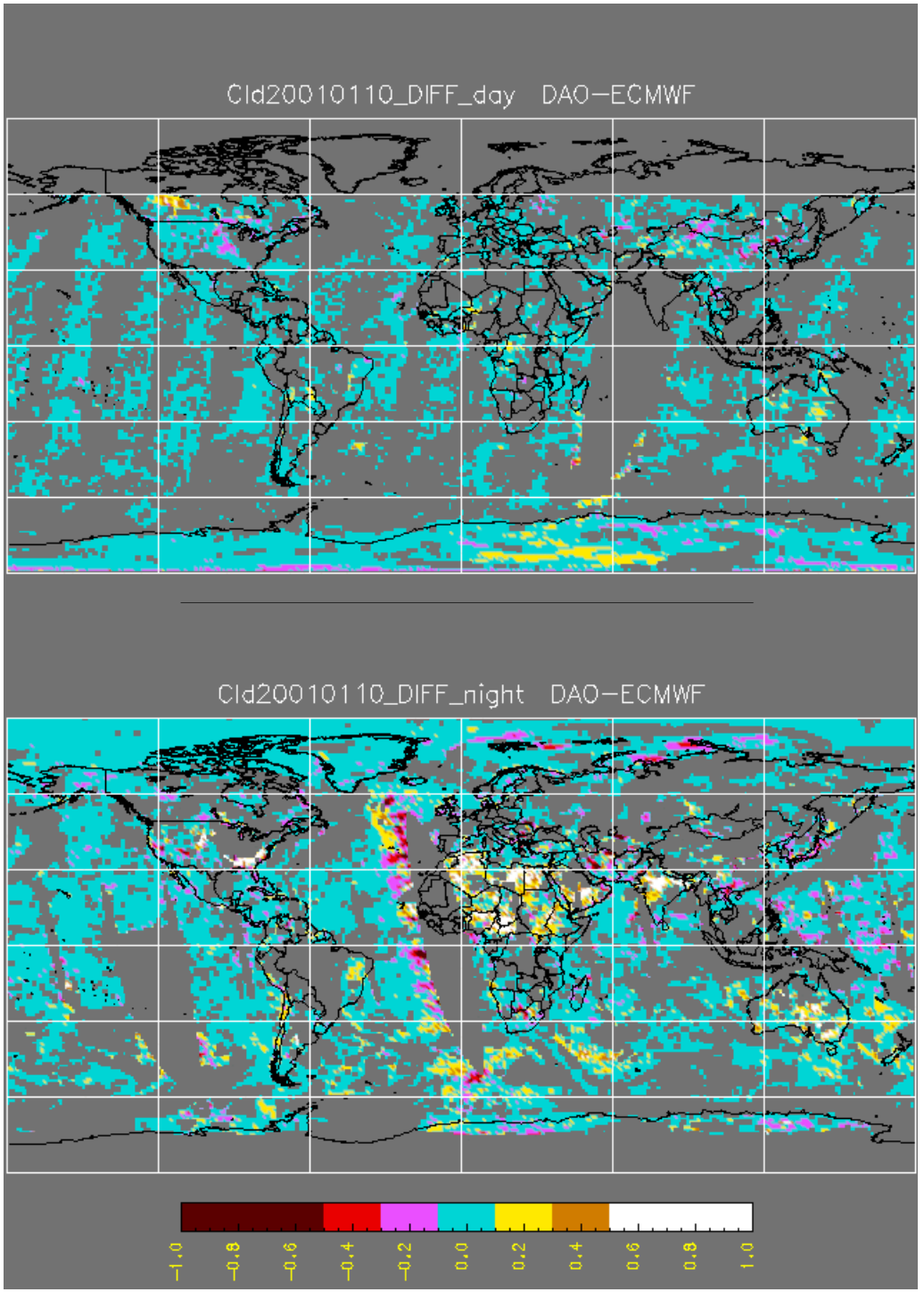
(K) LAND ONLY

	Non-Polar		Polar	
Day	**Mean**	**Std Dev**	**Mean**	**Std Dev**
EC	0.26	4.97	2.19	5.18
DA	0.39	5.12	0.21*	5.83
Night				
EC	2.54	3.30	1.48	3.15
DA	2.92	3.80	1.88	4.35

Daytime non-polar very similar. Elsewhere, DA is noisier. Night non-polar has extremes (2.5% of pixels) removed. Polar algos less dependent on Tskin.

** Absolute mean difference is 1.71K.*

Cloud Amount Differences 1/10/01



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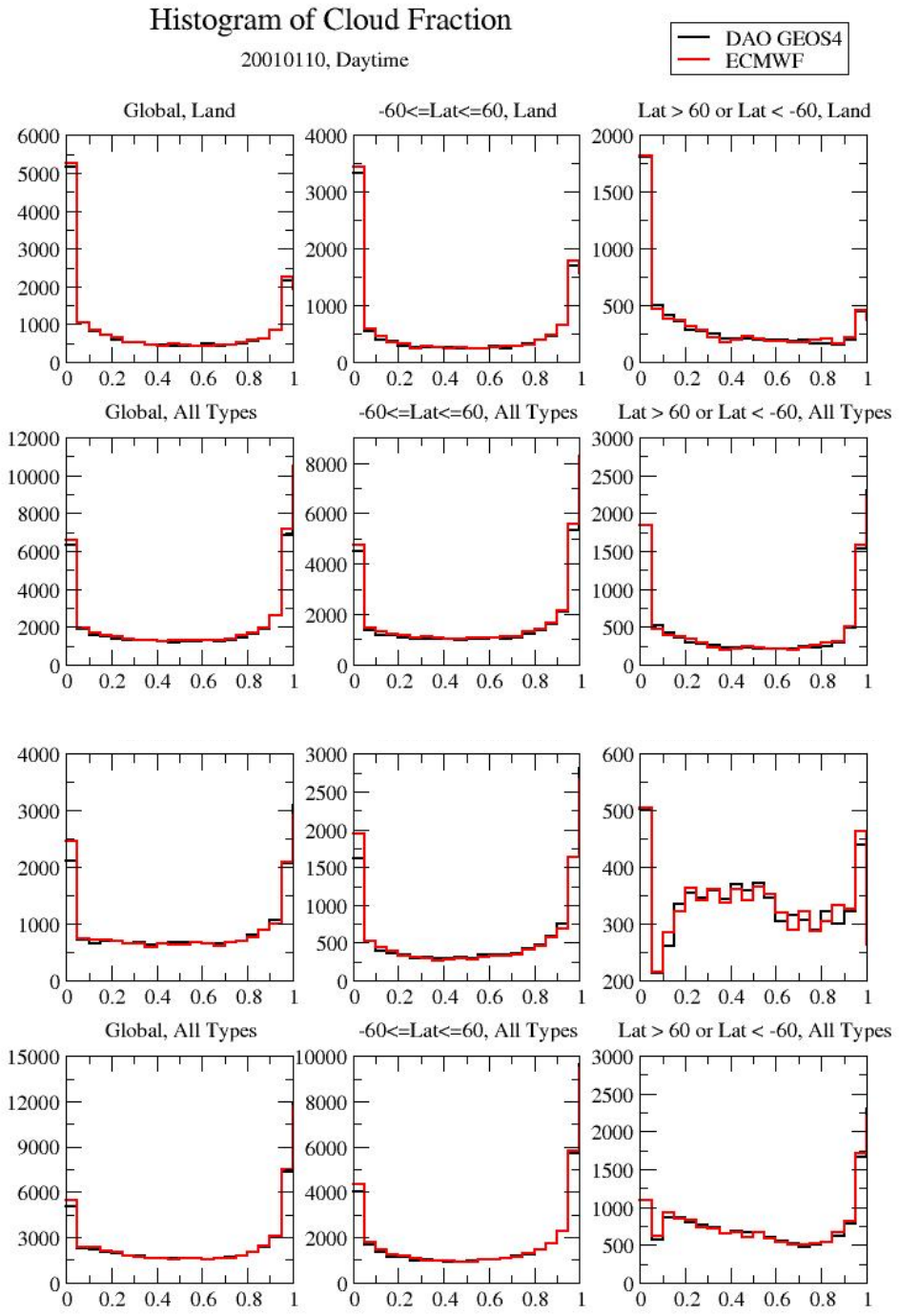


Day

Night

Cloud Amount Differences 1/10/01

Small differences in clear & overcast categories

Drop in DAO clear category compensated by increase in overcast in non-polar regions. More noisy in polar areas.

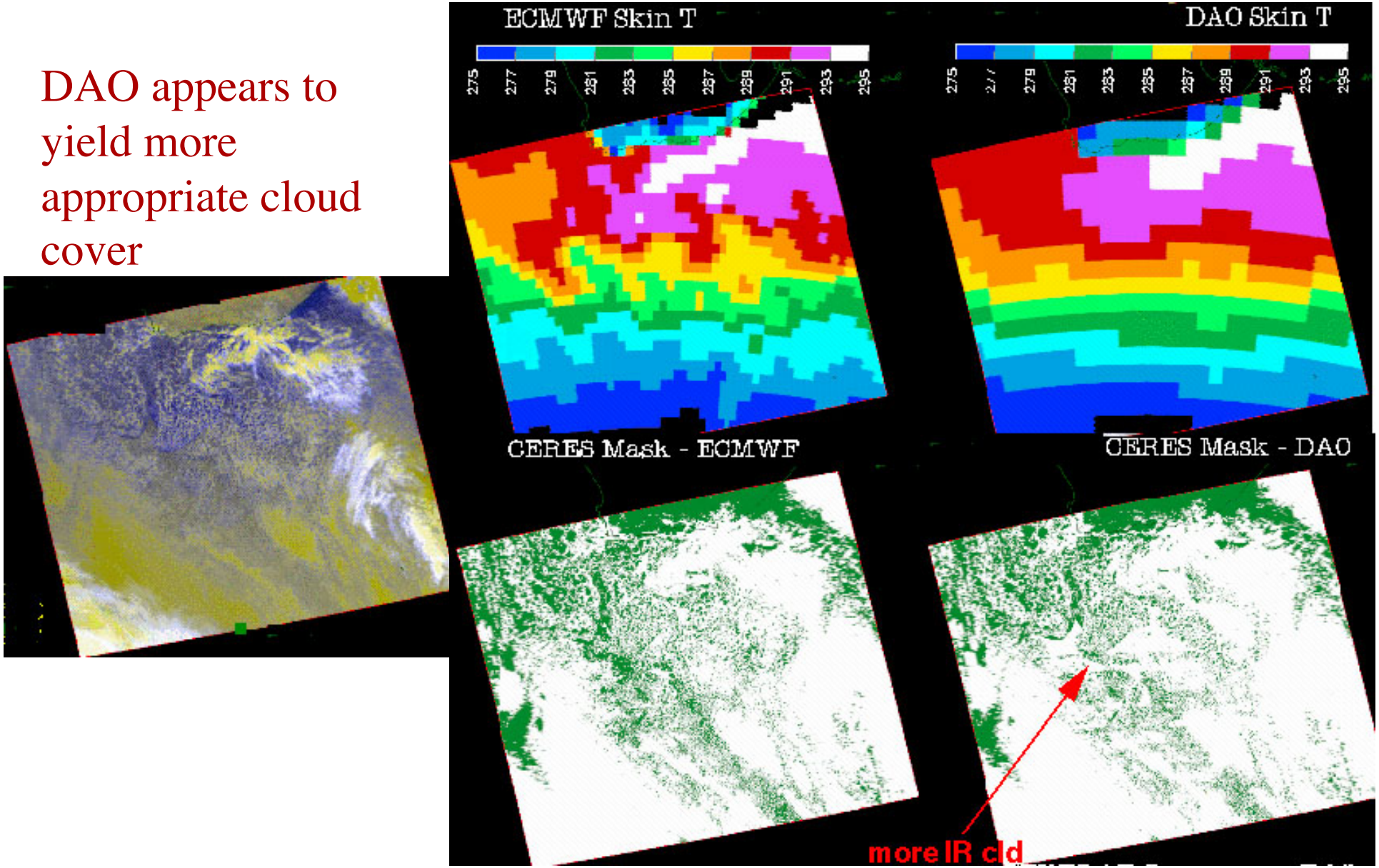
SUMMARY OF CLOUD AMOUNTS

	Land		Ocean	
Day	**Non-Polar**	**Polar**	**Non-Polar**	**Polar**
EC	0.496	0.544	0.686	0.799
DA	0.499	0.550	0.688	0.798
Night				
EC	0.543	0.614	0.670	0.663
DA	0.568	0.622	0.677	0.657

Mean differences are less than 1% for all categories except land at night.

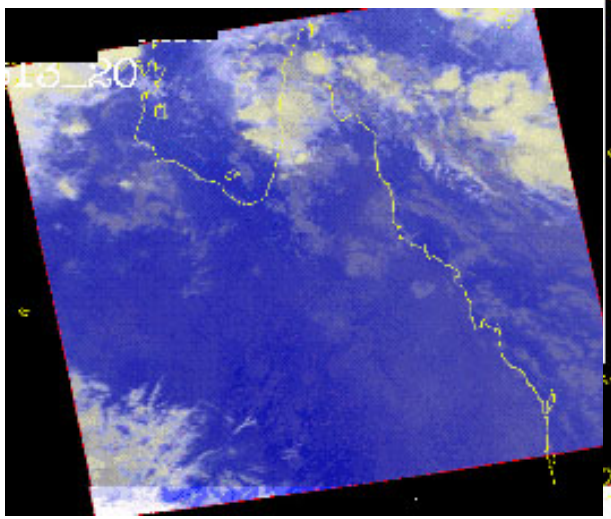
S. African Coast, 7/5/01, 2130 UTC

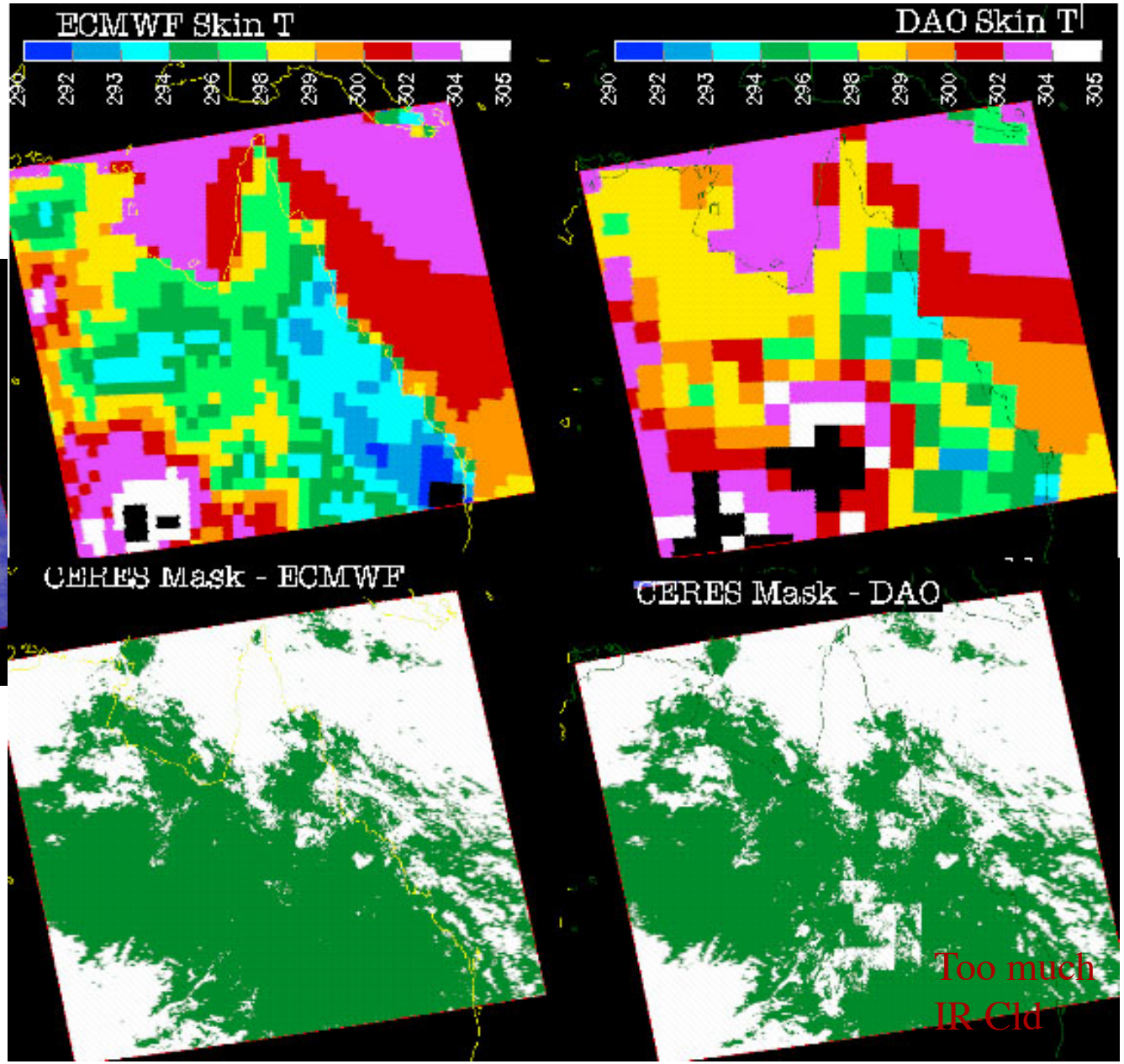
DAO appears to yield more appropriate cloud cover



Australia, January 3, 2001, 1320 UTC

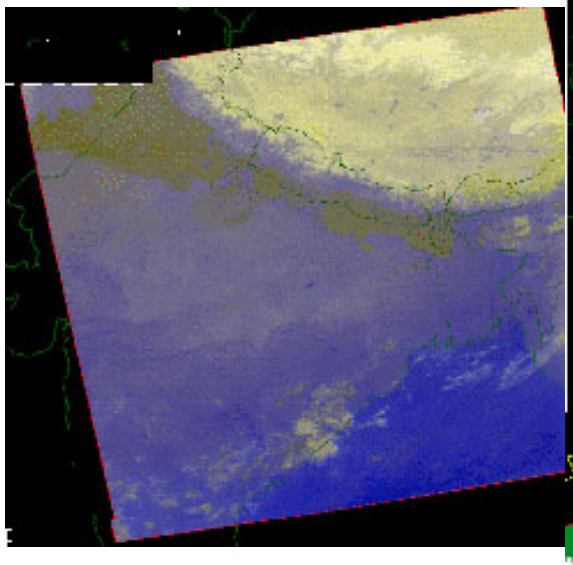
DAO surface too hot in center of desert

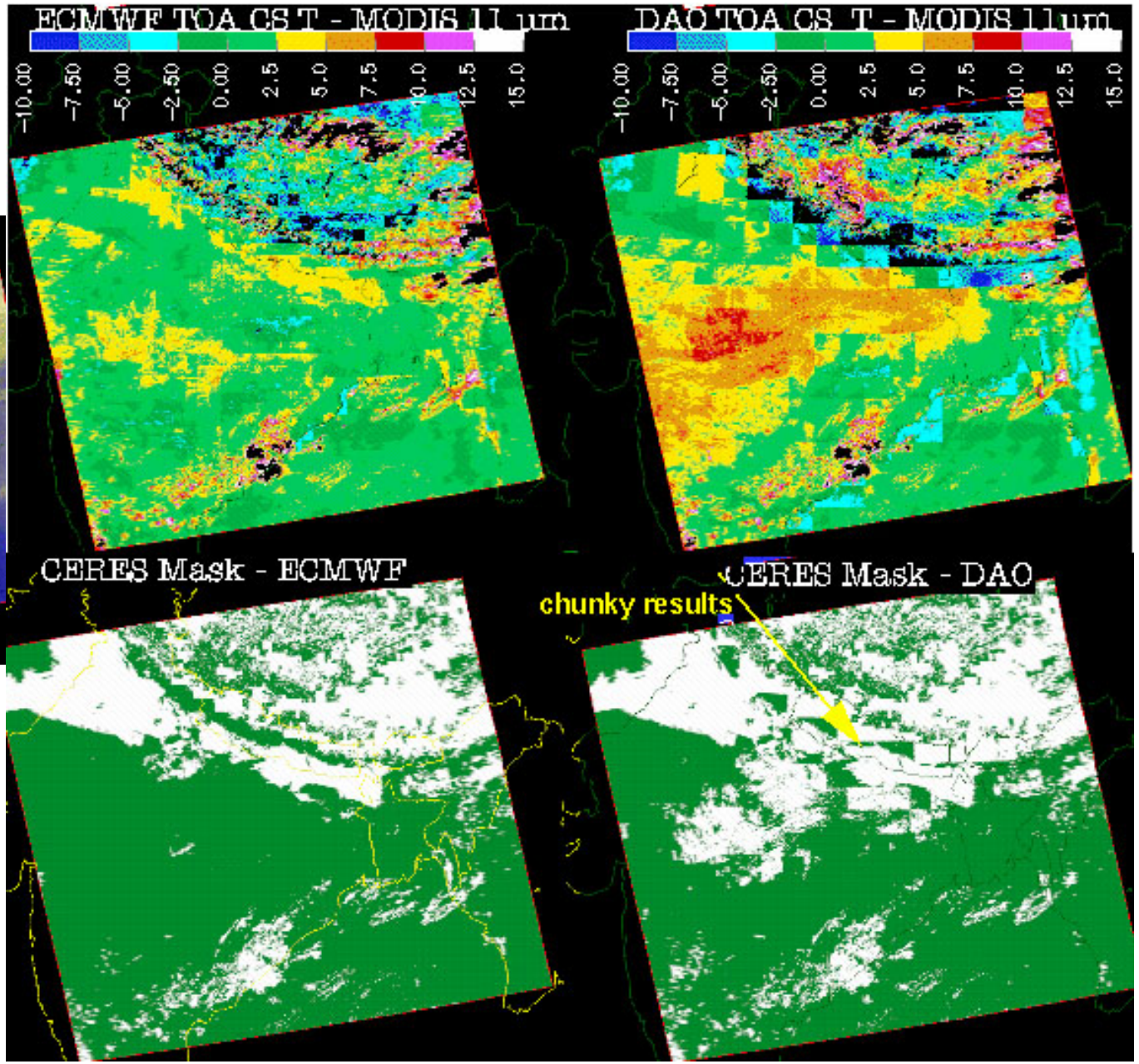




India, January 3, 2001, 1650 UTC

DAO too hot over northern India



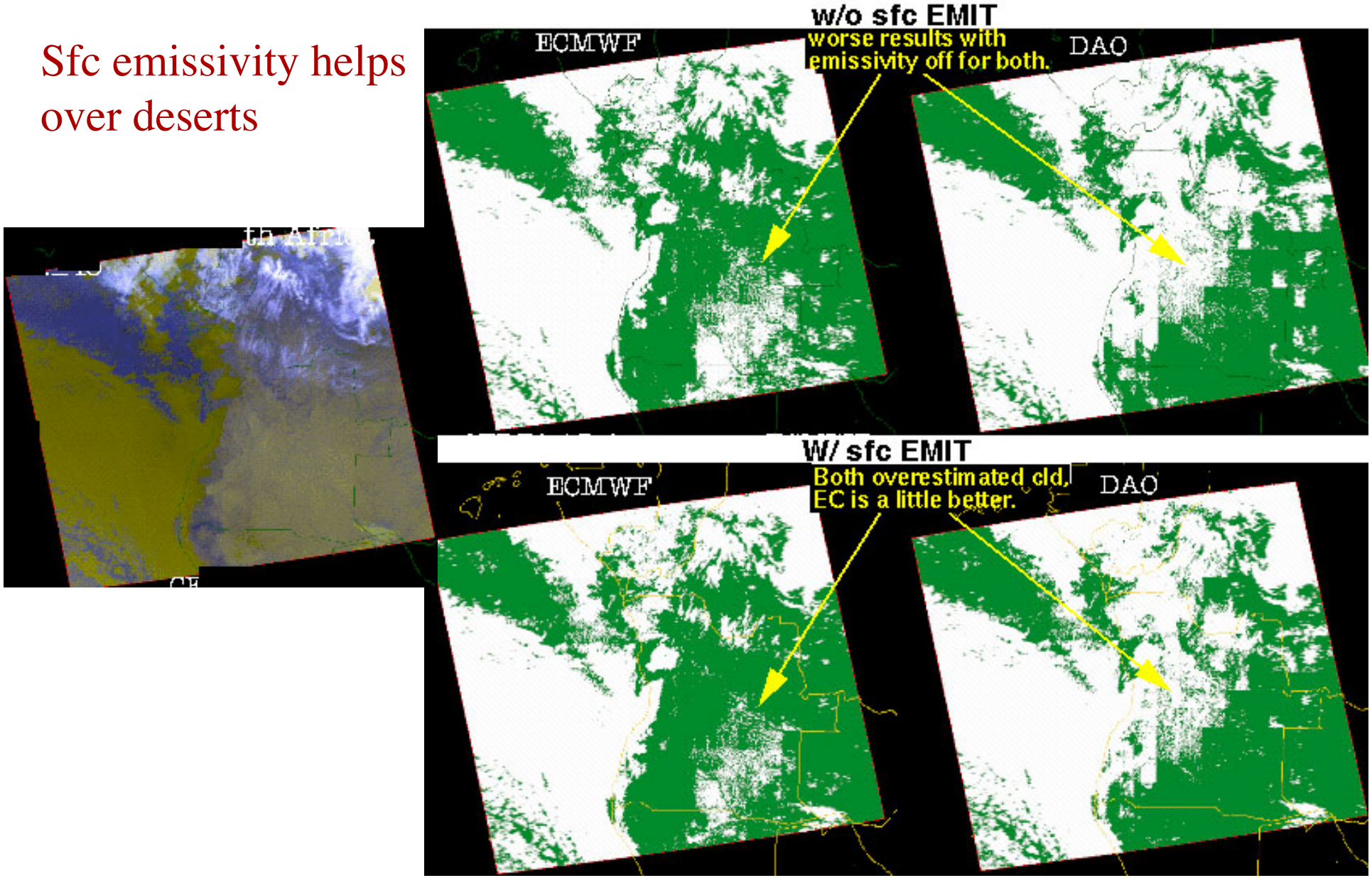


EC resolves mountains better

Nobody does Tibet right!

West South Africa, July 12, 2001, 2145 UTC

Sfc emissivity helps over deserts



VISUAL INSPECTION OF SELECTED SCENES WITH NIGHT CLOUD DIFFERENCES IN LARGE-SCALE MAPS

71 Scenes were examined.

Sfc emis was used.

Results: **38% no significant differences**

51% EC clearly better cloud amount

11% DA clearly better (mostly polar)

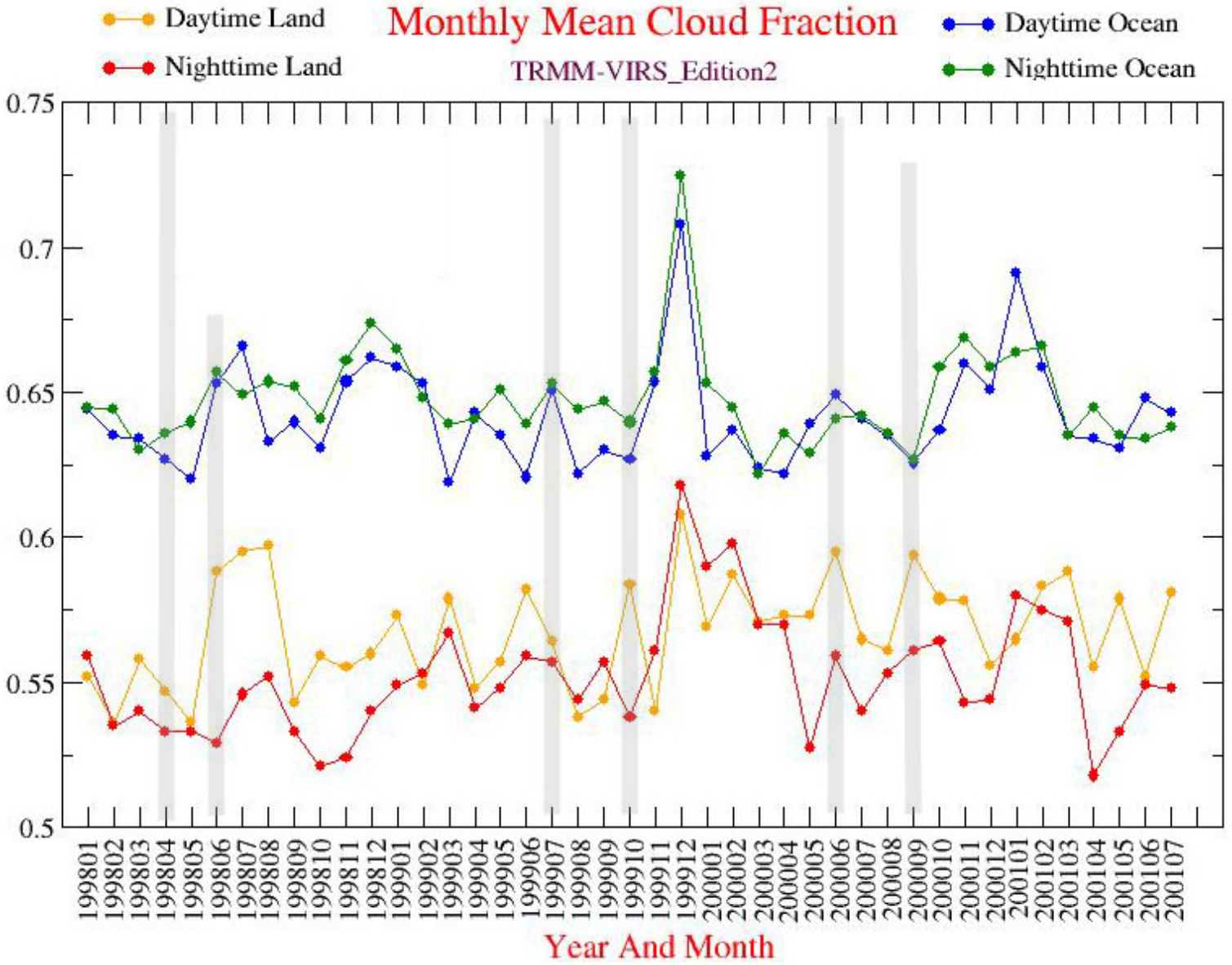
Sfc emis was not used.

Results: **54% no significant differences** **(Polar cases hard to decipher)**

42% EC clearly better

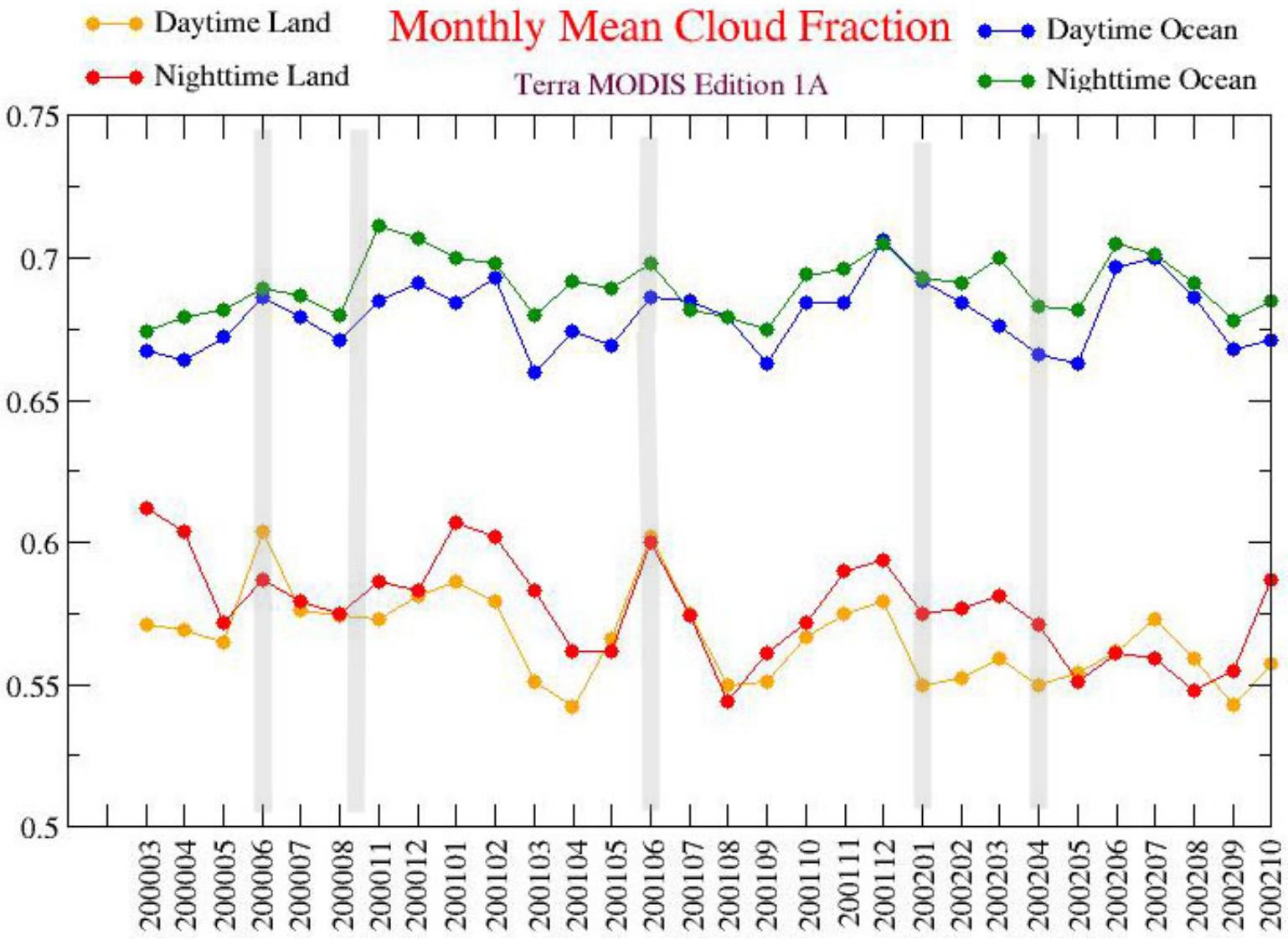
4% DA clearly better

Time Series of VIRS Cloud Amount & ECMWF Changes



VIRS seasonal cycle hard to visually remove; spike in 12/99 unrelated to EC changes.
Winter peak over ocean

Time Series of Terra Cloud Amount & ECMWF Changes



Difficult to relate the changes on this time scale; some tendency for decreasing cloudiness over land. 6 month cycle apparent, day-night diff least during summer-fall over land.

SUMMARY

- EC & DAO comparable Tskin over nonpolar land during day
- Ocean temps close also
- Night DAO temps run high over land, affect desert cloud
    - Is difference emissivity? Or model?
- Polar Tskin noisy for both, DAO a little worse
    - Minimal effect on cloud fraction
- Mean cloud fractions within 1% everywhere but night land
    - DAO causes 2.5% overestimate over land at night
- Time series inconclusive (too short, too much seasonal noise)

INITIAL EVALUATION OF MASK CHANGES FOR USING GEOS IN PLACE OF ECMWF

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October 15, 2003

ADDENDUM TO PREVIOUS MEETING THAT RESULTED IN DECISION TO USE DAO

• The DAO and EC runs used in the evaluation differ somewhat from the latest versions. Therefore, the statistics may have been somewhat off. The exact magnitude is probably not large but the new and old EC runs differ slightly. We have not yet run the DAO with no change using the correct version of the code.

OBJECTIVE:

Determine if adjustment of the IR threshold and/or inclusion of the 11 & 12 μm surface emissivities yield a favorable change in the cloud fraction as derived using GEOS as input.

BACKGROUND

- GEOS 4 produces cloud statistics that are similar to those derived using ECMWF

- Cloud mask clearly inferior

- Any adjustment of cloud mask must be easy and quick to implement.

DATA

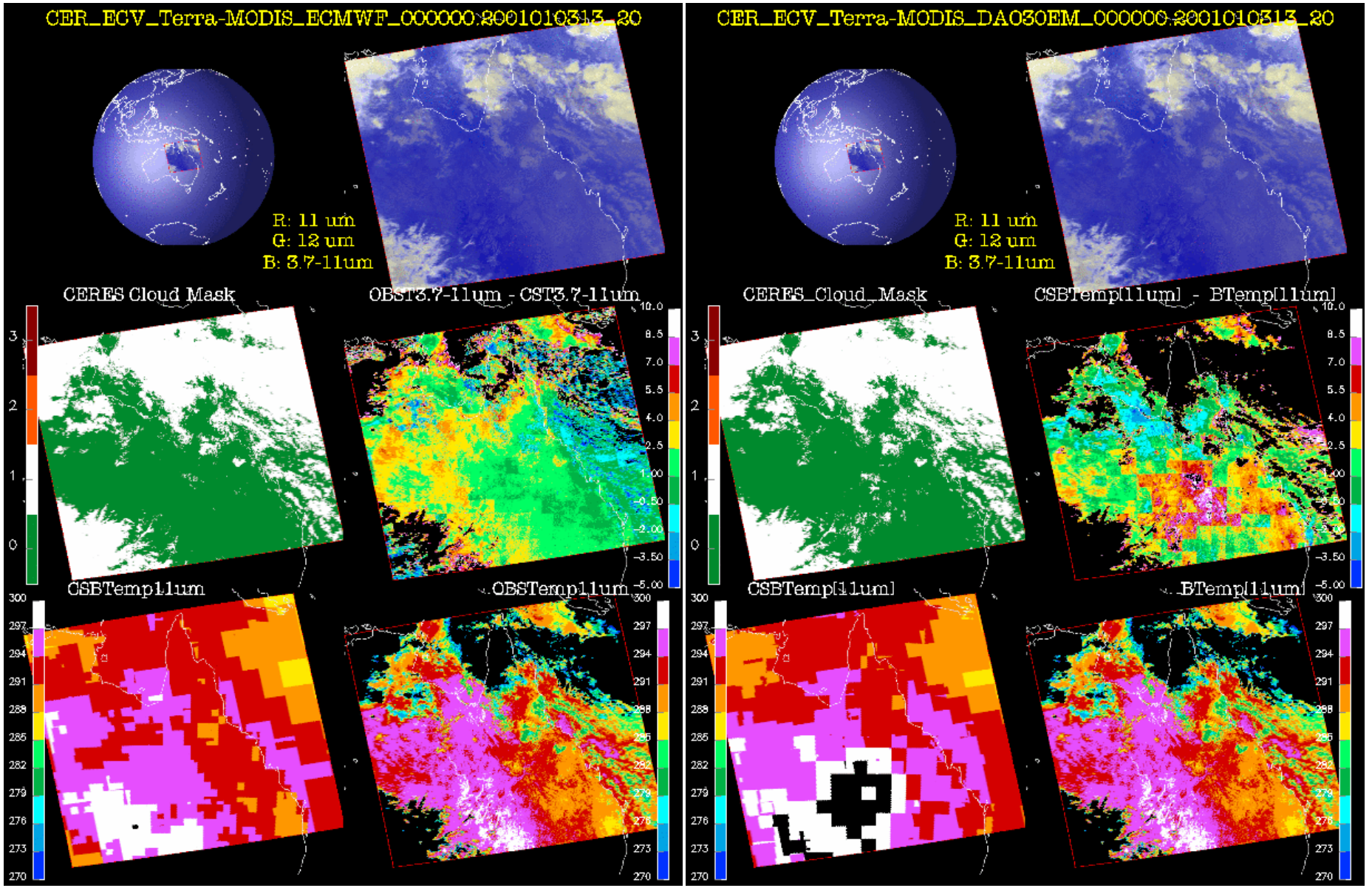
Parameter	ECMWF	DAO, GEOS 4.0.3
Profiles, x-y	1°	1°
Skin T, x-y	0.5°	1°
Profiles, t	6 hr	6 hr
Skin T, t	3 hr	3 hr

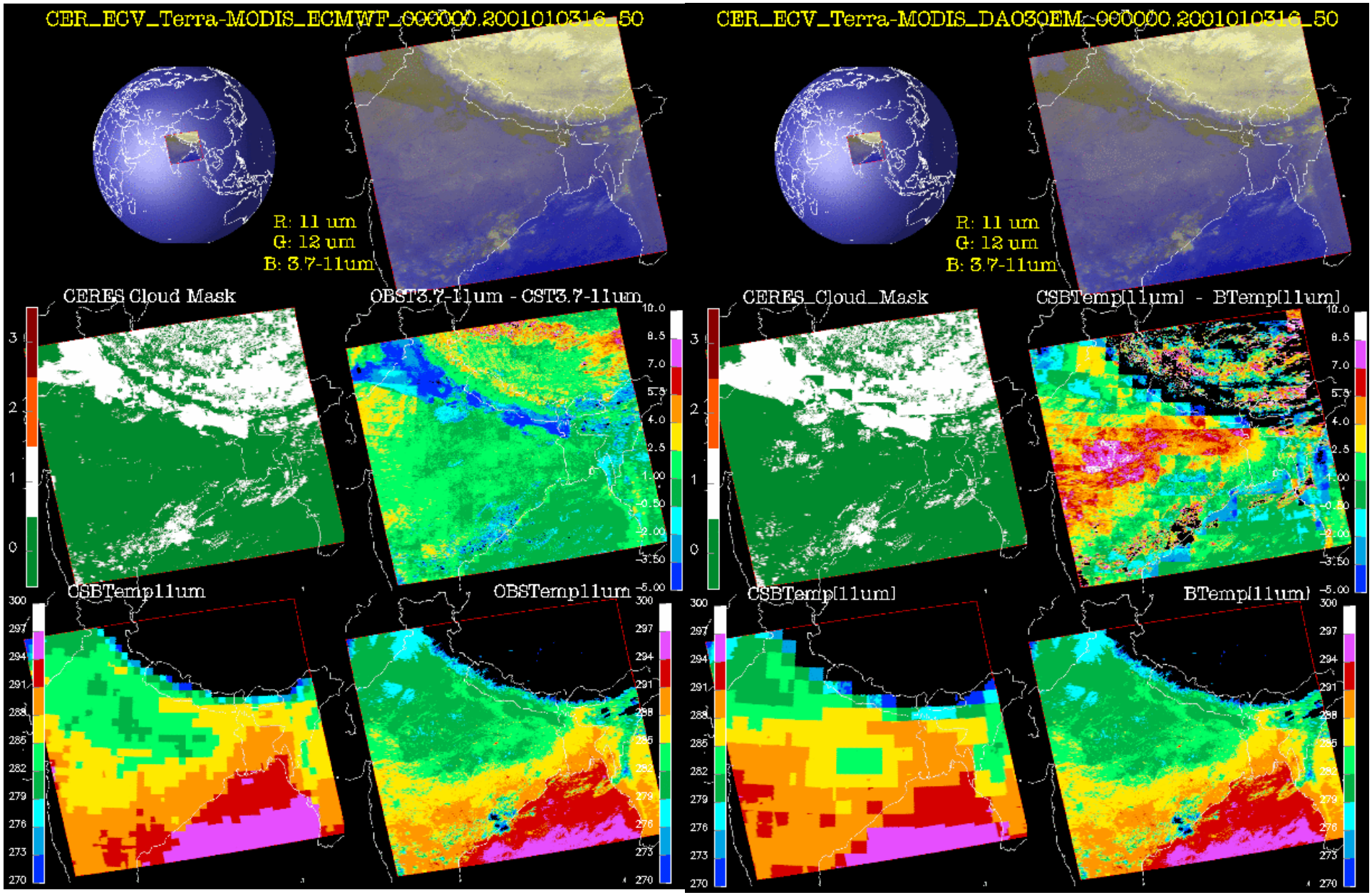
Dates, 2001 (limited because some data were not staged)

January 3, 10, 17; April 4; July 12; October 14

TEST CRITERIA

1. GEOS run using current mask specifications
    - 3.7-μm emis on; no 11 & 12 μm emis
    - see Addendum to previous meeting
2. GEOS with IR threshold differential increased by 15%
3. GEOS with IR threshold differential increased by 30%
4. Same as case 3, except 11 & 12-μm emis on


CER_ECV_Terra-MODIS_ECMWF_000000.200101031313_20
R: 11 um
G: 12 um
B: 3.7-11um
CERES Cloud Mask
OBST3.7-11um - CST3.7-11um
CSBTemp11um
OBSTemp11um
CER_ECV_Terra-MODIS_DAO30EM_000000.200101031313_20
R: 11 um
G: 12 um
B: 3.7-11um
CERES_Cloud_Mask
CSBTemp[11um] - BTemp[11um]
CSBTemp[11um]
BTemp[11um]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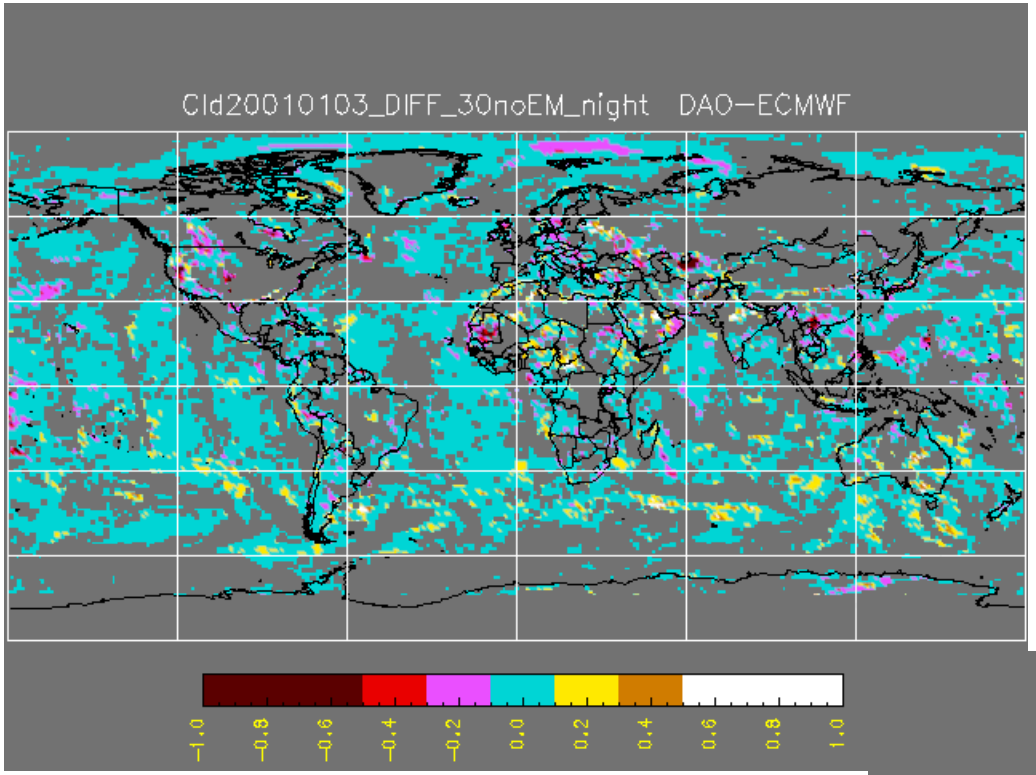
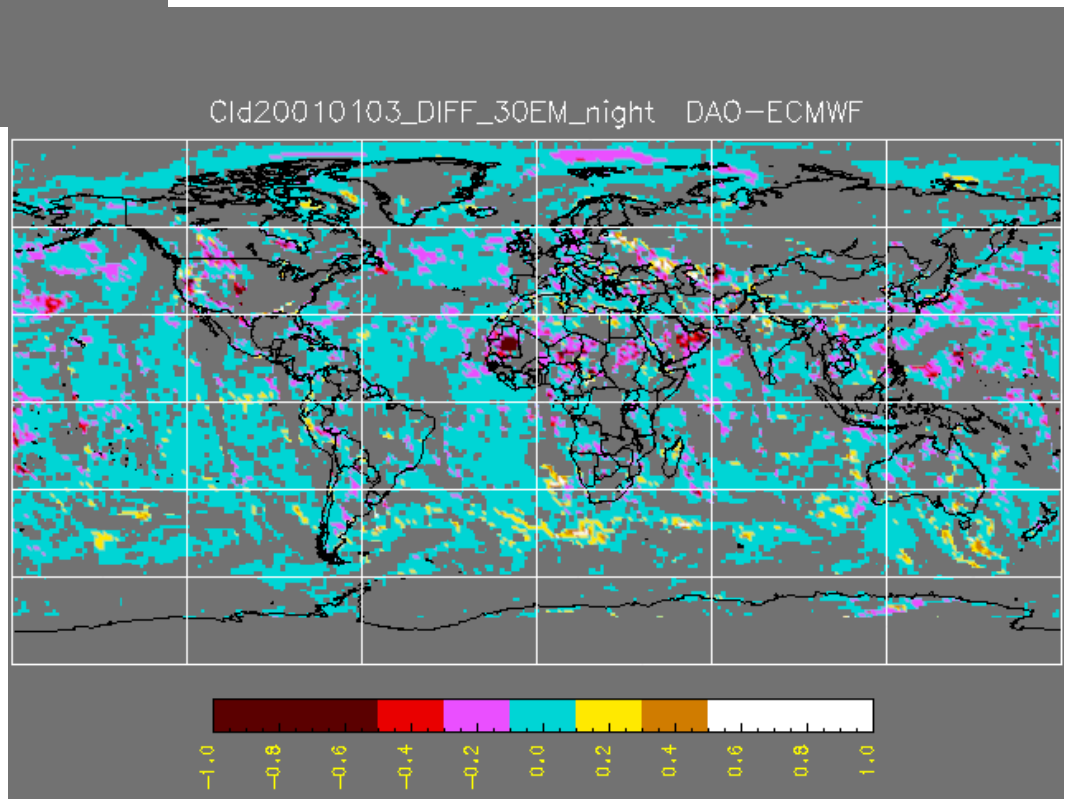
R: 11 um
G: 12 um
B: 3.7-11um
CERES Cloud Mask
OBST3.7-11um - CST3.7-11um
CSBTemp11um
OBSTemp11um
CER_ECV_Terra-MODIS_DAO30EM_000000.2001010316_50
R: 11 um
G: 12 um
B: 3.7-11um
CERES_Cloud_Mask
CSBTemp[11um] - BTemp[11um]
CSBTemp[11um]
BTemp[11um]


Cld20010103_DIFF_30noEM_night DAO−ECMWF
−1.0
−0.8
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
1.0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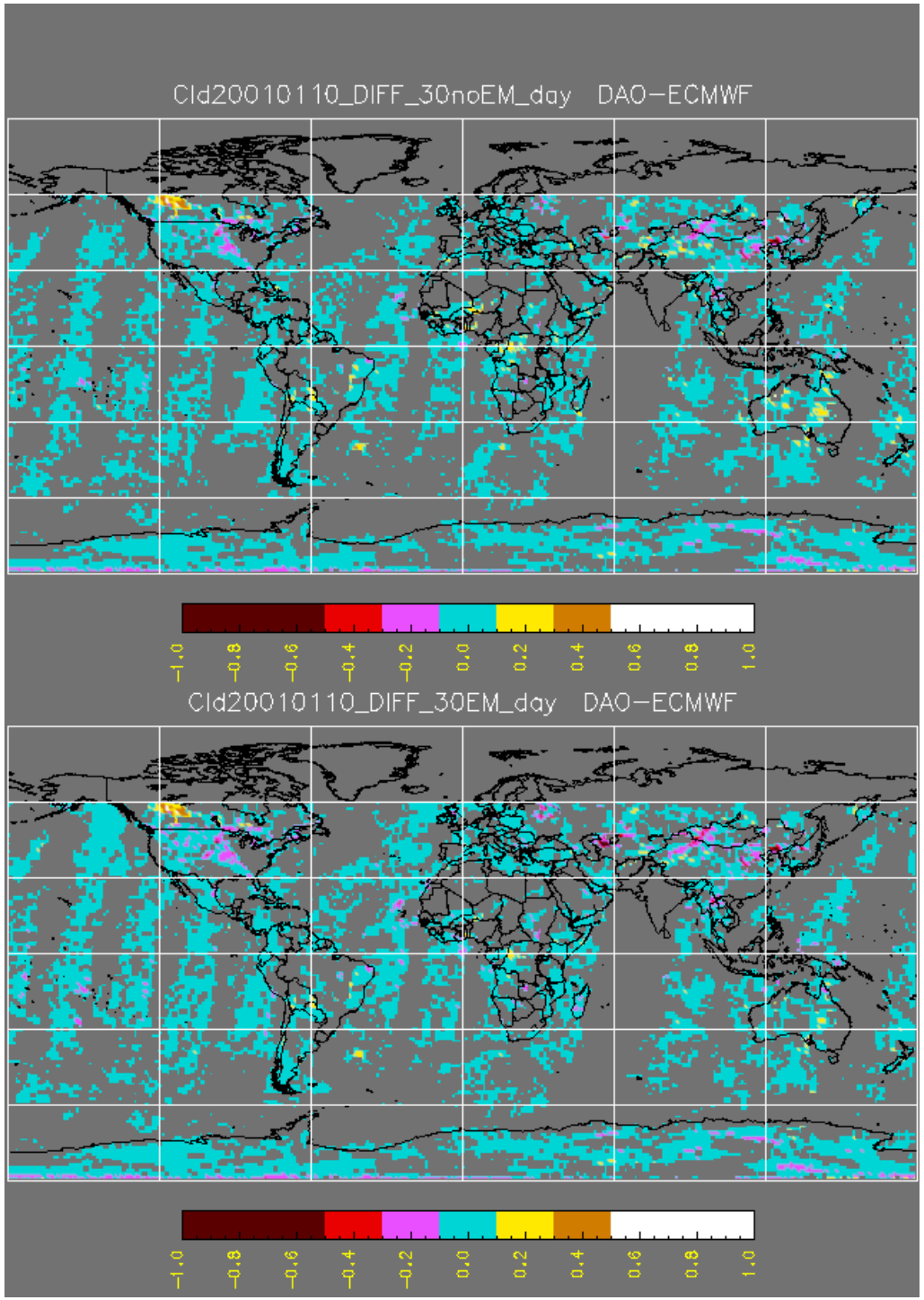
0.6
0.8
1.0

Daytime

Cloud Amount
Differences 1/10/01

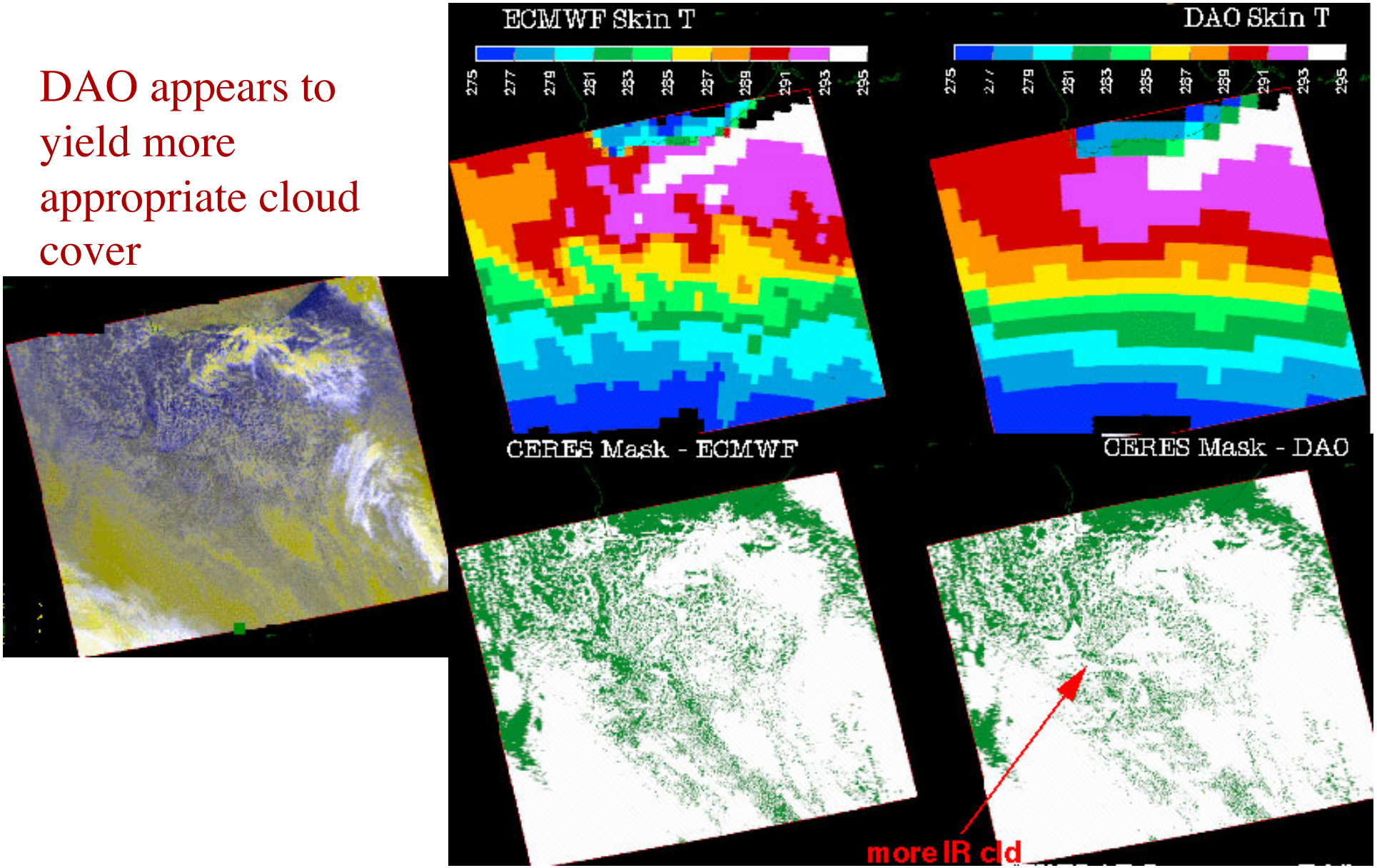


SUMMARY OF CLOUD AMOUNT DIFFS

	Land		Ocean	
Day	**Non-Polar**	**Polar**	**Non-Polar**	**Polar**
DA	0.003	0.006	0.002	-0.001
D30	-0.002	-0.003	0.002	0.002
D30E	-0.008	-0.003	-0.007	0.002
Night				
DA	0.025	0.008	0.007	-0.006
D30	-0.008	0.008	0.003	0.002
D30E	-0.035	0.010	-0.017	-0.017

S. African Coast, 7/5/01, 2130 UTC

DAO appears to yield more appropriate cloud cover



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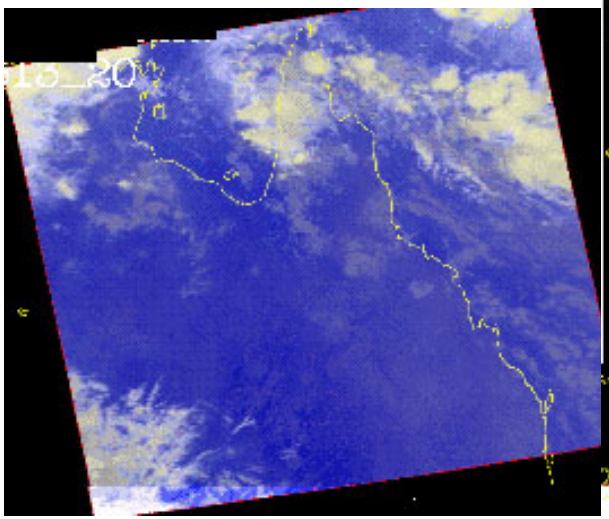

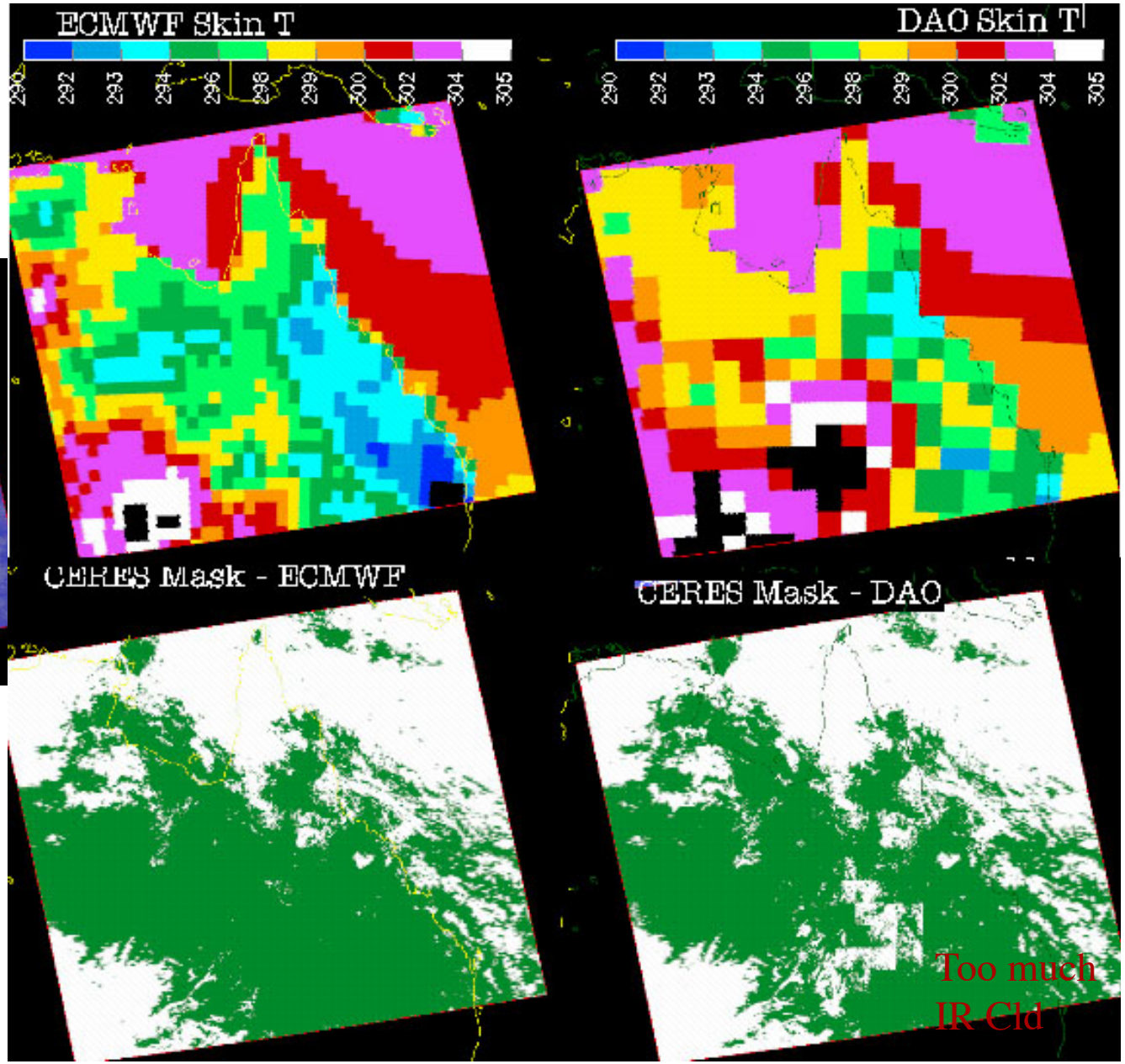

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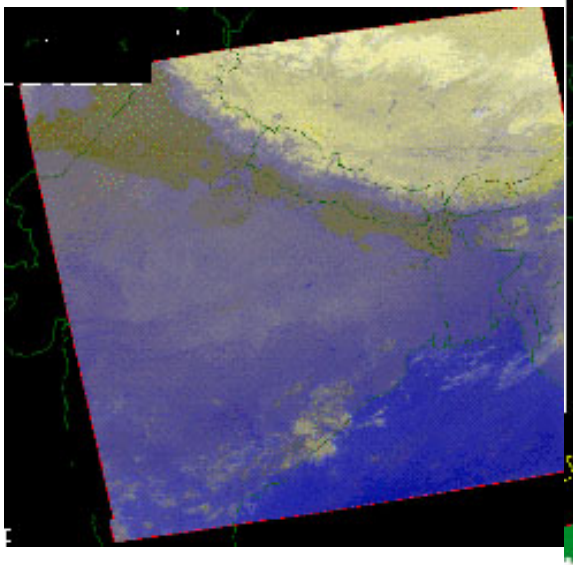

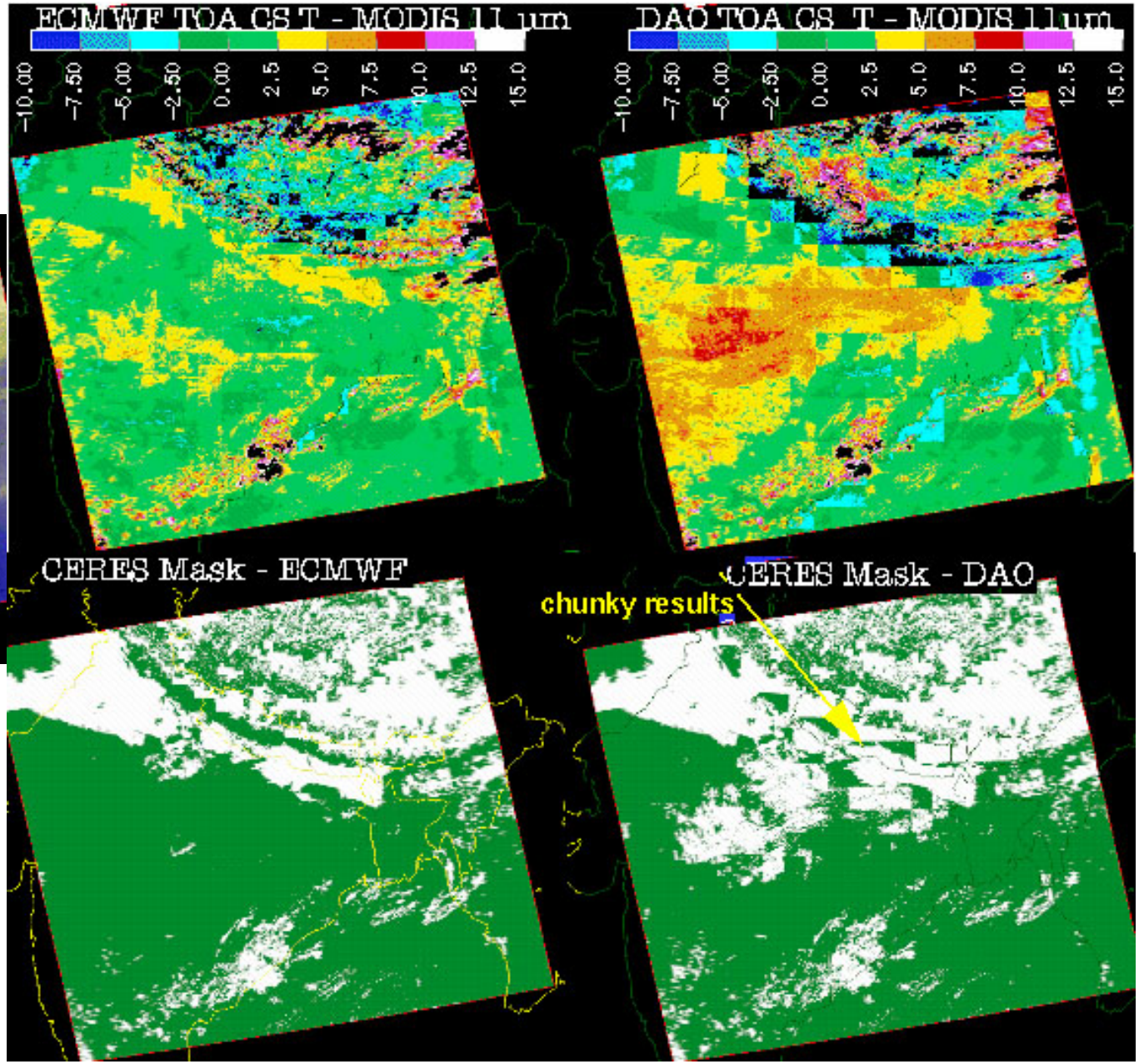

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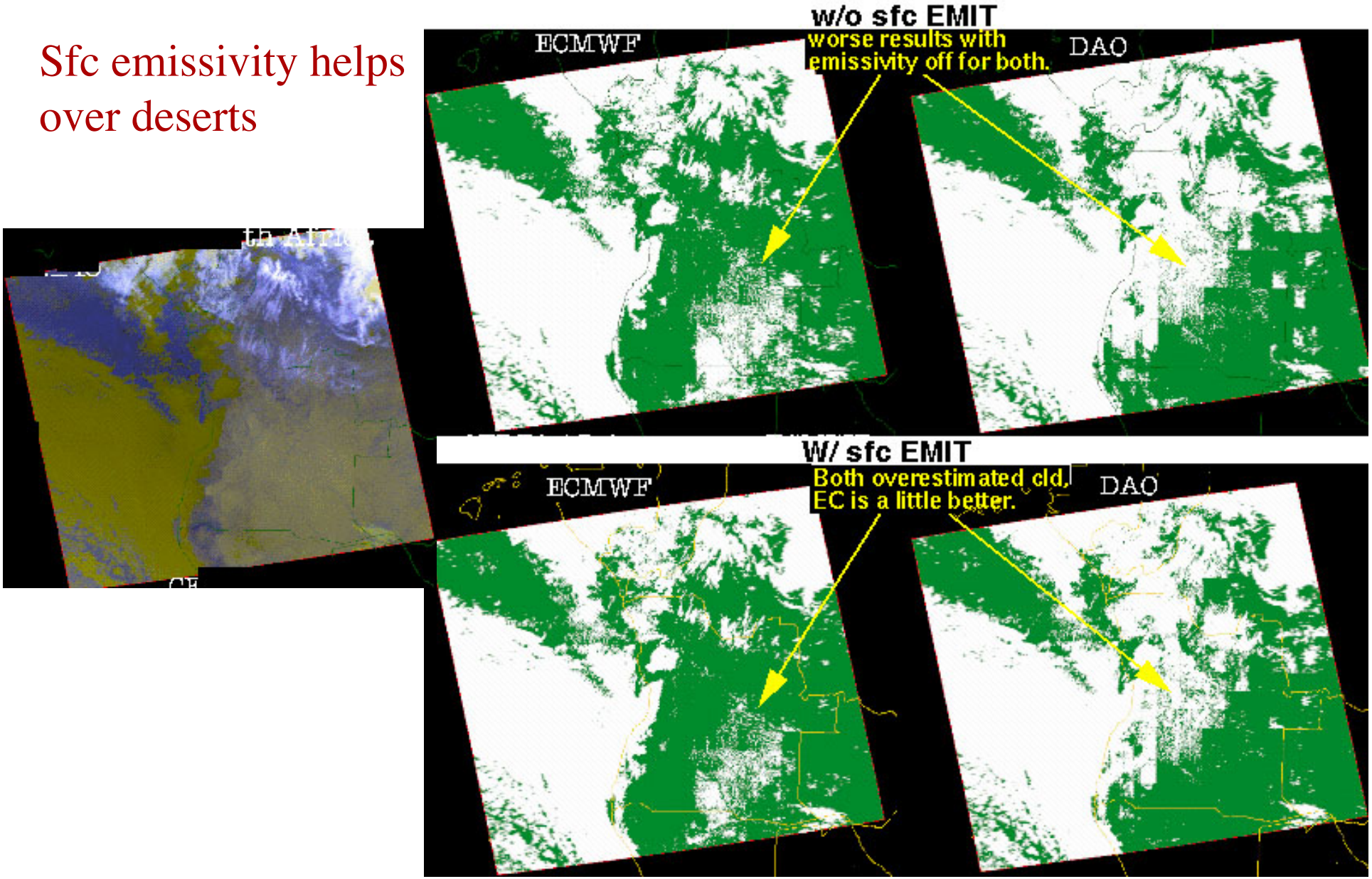

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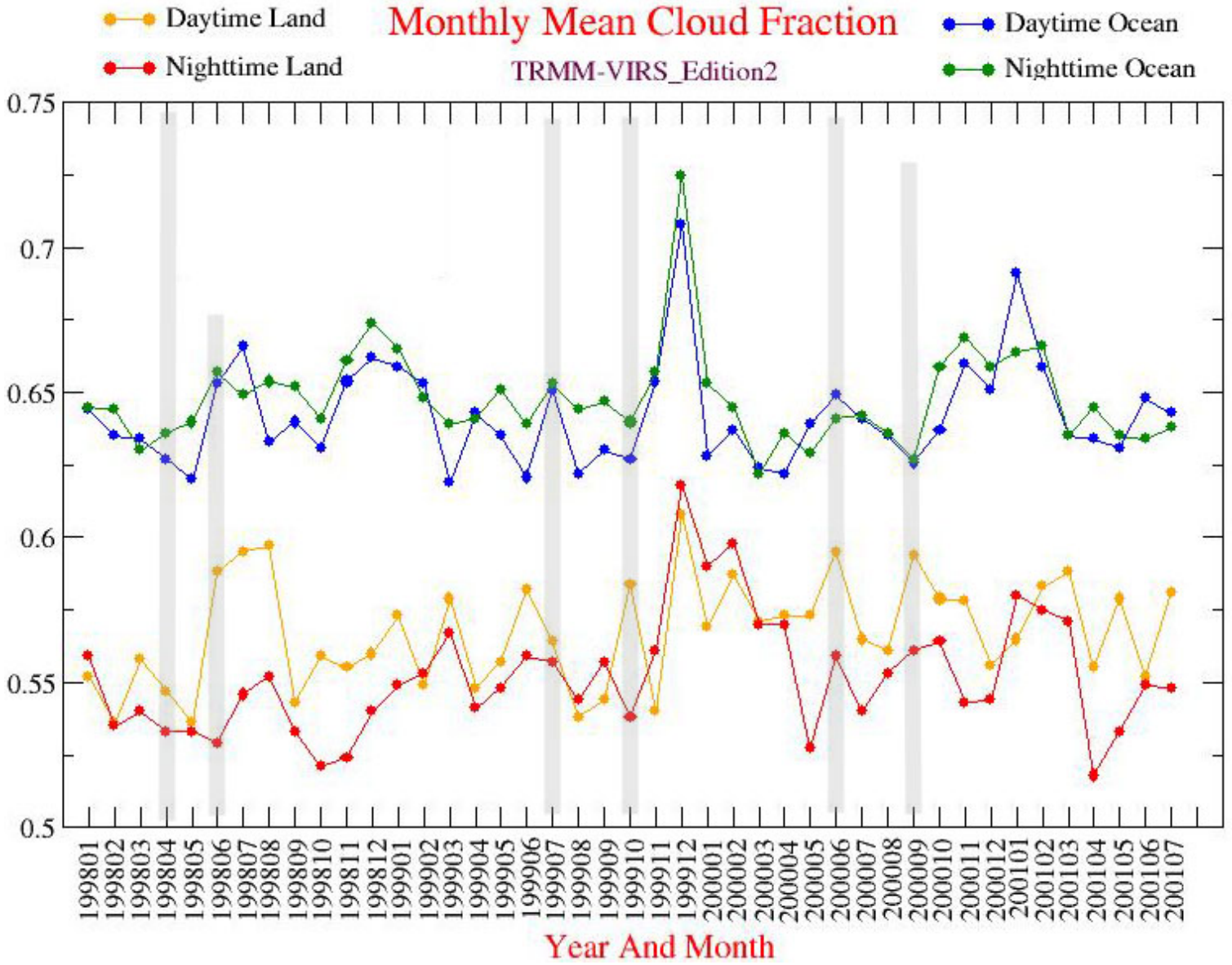

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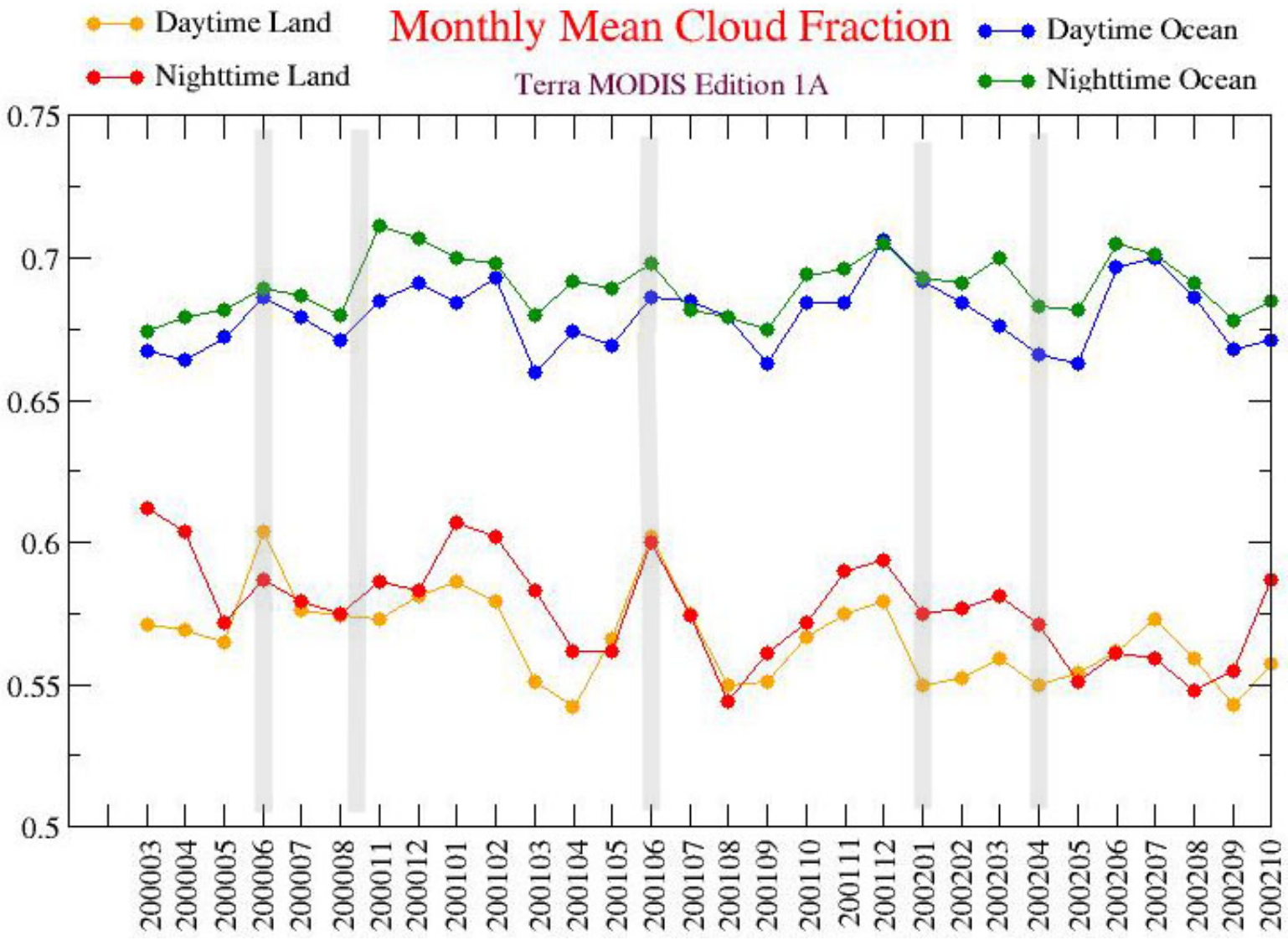

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